



Toxaphene Investigation Report

BROWN AND
CALDWELL



Environmental Consulting & Technology, Inc.

December 15, 2004

Mr. Robert Kukleski
Lead Environmental Engineer, Land Acquisition Support Division
South Florida Water Management District
3932 RCA Boulevard, Suite 3210
Palm Beach Gardens, Florida 33410

Re: Assessment Activity Results for Grids 66, 86, and 100 at the Woerner Turf Farm 2 Parcel, Tract 100-001, Palm Beach County, Florida

Dear Mr. Kukleski:

Environmental Consulting & Technology, Inc. (ECT) is pleased to present this letter report detailing the results of sampling activities conducted in grids 66, 86, and 100 at the Woerner Turf Farm 2 parcel. This assessment activity was prompted by a September 20, 2004 telephone conversation with District project personnel due to a need to construct a canal through these grids during the course of the next year 2005.

1.0 BACKGROUND

ECT has conducted Phase II and Phase III sampling activities on the 4,300 acre parcel known as Woerner Turf Farm 2 and prepared reports documenting toxaphene impacts across the property. While discussions with the US Fish and Wildlife Service (USFWS) continue as to the disposition of the parcel with respect to use as a storm water treatment area, District project personnel have indicated an immediate need for a small portion on the eastern boundary of the property. The subject portion is a 200 foot wide strip confined within grids 66, 86, and 100 as identified in ECT's Phase III report (ECT No. 03-0463) and indicated on Figure 1.

2.0 SCOPE OF WORK

In accordance with concerns raised by USFWS regarding toxaphene impacts, ECT collected 23 discrete soil samples on approximately 210 foot centers. The sampling locations were selected to provide representative spatial distribution for the area and the sampling density was more rigorous than that specified by the sampling protocol agreed upon by the District and USFWS.

The precise locations were predetermined using GPS and the locations have been recorded for future reference. The sampling locations are depicted on Figure 2. The samples were collected from 0-6 inches and each discrete sample was well mixed in a stainless steel mixing bowl. Each sample was analyzed for organochlorine pesticides by method 8081, copper by method 6010 and Total Organic Carbon by method 9060.

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3.0 DISCUSSION OF RESULTS

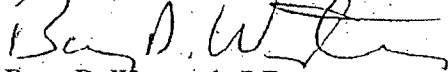
The analytical data for each sampling location is tabulated on Table 1. The maximum copper concentration that was detected was 50 mg/kg. The mean and 95% UCL for copper were 31.7 and 36.8 mg/kg, respectively. Since the mean, 95% UCL, and maximum detection fall below the interim screening value of 85 mg/kg for protection of the snail kite, copper is not considered to be a COPEC. The results indicated that no toxaphene was detected in any of the samples above the detection limits which ranged from 45 ug/kg to 420 ug/kg. The mean total organic carbon value was 9.4%. Using one half the detection limit for toxaphene for each sample the mean and 95% UCL were 78 ug/kg and 102 ug/kg respectively for the three grids. The chlordane concentration ranged from non-detect to 5.7 ug/kg. The mean and 95% UCL for chlordane were 2.0 and 2.4 ug/kg, respectively. Using a mean organic carbon content of 9.4% and entering these values into the fugacity based food web model indicates no hazard quotients above one for any trustee species of birds, trophic levels of fish or benthos. The model output is included as an attachment to this letter report.

On this basis it is ECT's opinion that if soil in grids 66, 86, and 100 was to become sediment no significant risk would be posed to trustee species of birds, fish or sediment dwelling organisms. The proposed development in this area should be deemed acceptable. Since the soil does not contain constituents at concentrations which are a concern no special handling or disposal will be required during the construction of the canal in this area. No other portions of the property will be developed at this time.

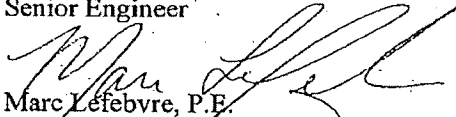
ECT appreciates the opportunity to be of service to the SFWMD on this project. Please do not hesitate to contact either of the undersigned if you have any questions.

Sincerely,

ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.



Barry D. Westmark, P.E.
Senior Engineer



Marc Lefebvre, P.E.
Principal Engineer
Department Manager

Attachments

FIGURES

SB-1

SB-2

SB-3

SB-4

SB-5

SB-6

SB-7

SB-8

SB-9

SB-10

SB-11

SB-12

SB-14

SB-15

SB-16

SB-17

SB-18

SB-19

SB-20

SB-21

SB-22

SB-23

SB-24

Legend

• GPS Locations

* Points of Origin

— line

600

Feet

TABLES

**Table 7.1. Cultivated Area Soil Samples Positive Detection
Woomer Turf Eastern Shrub (Grigs 66, 86, and 100)**

Sample ID	Copper (mg/kg)	alpha-Chlordane (ug/kg)	gamma-Chlordane (ug/kg)	Total Chlordane (ug/kg)	Toxaphene (ug/kg)	Total Organic Carbon (mg/kg dw)
SB-1	37	<1.6	<1.6	<1.6	<240	95,000
SB-2	27	<1.6	<1.6	<1.6	<57	120,000
SB-3	41	1.7	<1.6	1.7	<200	120,000
SB-4	36	3.1	2.6	5.7	<230	120,000
SB-5	43	2.3	<1.6	2.3	<290	100,000
SB-6	39	2.6	2.4	5	<260	100,000
SB-7	40	2.2	<1.6	2.2	<360	110,000
SB-8	5.8	<1.6	<1.6	<1.6	<280	50,000
SB-9	8.5	<1.6	<1.6	<1.6	<190	81,000
SB-10	30	<1.6	<1.6	<1.6	<47	130,000
SB-11	42	<1.6	<1.6	<1.6	<69	110,000
SB-12	49	<1.6	<1.6	<1.6	<61	140,000
SB-14	34	<1.6	<1.6	<1.6	<45	46,000
SB-15	50	<1.6	<1.6	<1.6	<420	100,000
SB-16	43	<1.6	<1.6	<1.6	<220	120,000
SB-17	8.8	<1.6	<1.6	<1.6	<45	36,000
SB-18	9.6	<1.6	<1.6	<1.6	<45	37,000
SB-19	32	<1.6	<1.6	<1.6	<74	140,000
SB-20	12	<1.6	<1.6	<1.6	<51	66,000
SB-21	17	<1.6	<1.6	<1.6	<47	16,000
SB-22	44	<1.6	<1.6	<1.6	<64	110,000
SB-23	31	<1.6	<1.6	<1.6	<230	99,000
SB-24	50	<1.6	<1.6	<1.8	<78	120,000

MODEL OUTPUT

RECOMMENDED ENVIRONMENTAL EXPOSURE POINT CONCENTRATIONS (EPCs)

Copper Soil

There is a sufficient number of values for statistical analysis - the data were found to be non-normally distributed with high bias and low skewness - use the Standard Bootstrap mean and "t" Bootstrap UCLs as the EPCs

(Nondetect data presented as 1/2 the DL)

Units = PPB

Sample#	Value	Qualifier
SB-1	37	
SB-2	27	
SB-3	41	
SB-4	36	
SB-5	43	
SB-6	39	
SB-7	40	
SB-8	5.8	
SB-9	8.5	
SB-10	30	
SB-11	42	
SB-12	49	
SB-14	34	
SB-15	50	
SB-16	43	
SB-17	8.8	
SB-18	9.6	
SB-19	32	
SB-20	12	
SB-21	17	
SB-22	44	
SB-23	31	
SB-24	50	

Low-End EPC		Bootstrap Mean		31.66986522	
High-End EPC		Pivotal Bootstrap UCL		36.76812702	
Raw Data Results					
Number of Samples		23			
Percent Detection		100%	23 of 23	Percent Detects J-coded 0%	
Maximum Detection		5.00E+01		Minimum Detection 5.80E+00	
Maximum Non-detection ¹		All Detects		Minimum Non-detection ¹ All Detects	
Normal (Non-transformed) Results					
Normal Mean		3.17E+01		Mean Standard Error 3.01E+00	
Standard Deviation		1.45E+01		Coefficient of Variance (%) 46%	
Dataset Skewness		Pass	-5.57E-01	Dataset Kurtosis Fail 1.85E+00	
Tested for Normality		W-Test		NormalityResult (a = 0.05) Fail	
Critical Value		9.14E-01		Calculated Value for dataset 8.90E-01	
90% UCL using t-statistic		3.57E+01		95% UCL using -t-statistic 3.69E+01	
Natural Log-Transformed Results					
MVUE of the log-mean		3.32E+01		Standard error of the log-mean 4.89E+00	
Standard Deviation		6.62E-01		Coefficient of Variance (%) 20%	
Dataset Skewness		Pass	-1.05E+00	Dataset Kurtosis Pass 2.55E+00	
Tested for Normality		W-Test		Normality Result (a = 0.05) Fail	
Critical Value		9.14E-01		Calculated Value for dataset 7.99E-01	
Anderson Darling (AD) A ²		1.97E+00		AD Probability Fail 9.53E-02	
90% UCL of the MVUE		4.21E+01		95% UCL of the MVUE 4.53E+01	
EPA Concentration Term		4.53E+01		Chebychev 95% UCL 5.51E+01	
Jackknife Results					
Jackknifed Mean		3.17E+01		Jackknifed Standard Error 3.01E+00	
90% UCL of the mean		3.57E+01		95% UCL of the mean 3.69E+01	
90% UCL of the MVUE ²		3.75E+01		95% UCL of the MVUE ² 3.88E+01	
Bootstrap Results (Raw Data)					
Standard Bootstrap		Mean	3.17E+01	90% UCL 3.54E+01	95% UCL 3.65E+01
Skewness		-1.48E-01		Kurtosis 3.01E+00	
Quantile fit is good - Bootstrap Output is Normal or nearly so					
Pivitol (t) Bootstrap		90% UCL 3.55E+01		95% UCL 3.68E+01	
Skewness		4.43E-01		Kurtosis 4.31E+00	
Quantile fit is good - Bootstrap Output is Normal or nearly so					
Hall's t Bootstrap		90% UCL 3.55E+01		95% UCL 3.67E+01	
Skewness		1.17E+00		Kurtosis 7.89E+00	
Quantile fit is good - Bootstrap Output is Normal or nearly so					

RECOMMENDED ENVIRONMENTAL EXPOSURE POINT CONCENTRATIONS (EPCs)

Chlordane

Soil

There is a sufficient number of values for statistical analysis - the data were found to be non-normal with high skewness, however, the Hall's transformed t bootstrap failed to normalize the dataset - use the Standard Bootstrap mean and UCLs as the EPCs

(Nondetect data presented as 1/2 the DL)

Units = PPB

Sample#	Value	Qualifier
SB-1	1.6	
SB-2	1.6	
SB-3	1.7	
SB-4	5.7	
SB-5	2.3	
SB-6		
SB-7	2.2	
SB-8	1.6	
SB-9	1.6	
SB-10	1.6	
SB-11	1.6	
SB-12	1.6	
SB-14	1.6	
SB-15	1.6	
SB-16	1.6	
SB-17	1.6	
SB-18	1.6	
SB-19	1.6	
SB-20	1.6	
SB-21	1.6	
SB-22	1.6	
SB-23	1.6	
SB-24	1.8	

Low-End EPC		Bootstrap Mean		2.01413913	
High-End EPC		Standard Bootstrap UCL		2.386150805	
Raw Data Results					
Number of Samples		23			
Percent Detection		100%	23 of 23	Percent Detects J-coded 0%	
Maximum Detection		5.70E+00		Minimum Detection 1.60E+00	
Maximum Non-detection ¹		All Detects		Minimum Non-detection ¹ All Detects	
Normal (Non-transformed) Results					
Normal Mean		2.00E+00		Mean Standard Error 2.25E-01	
Standard Deviation		1.08E+00		Coefficient of Variance (%) 54%	
Dataset Skewness		Fail	2.65E+00	Dataset Kurtosis Fail 8.63E+00	
Tested for Normality		W-Test		NormalityResult (a = 0.05) Fail	
Critical Value		9.14E-01		Calculated Value for dataset 4.20E-01	
90% UCL using t-statistic		2.29E+00		95% UCL using -t-statistic 2.38E+00	
Natural Log-Transformed Results					
MVUE of the log-mean		1.96E+00		Standard error of the log-mean 1.46E-01	
Standard Deviation		3.50E-01		Coefficient of Variance (%) 57%	
Dataset Skewness		Fail	2.42E+00	Dataset Kurtosis Fail 7.57E+00	
Tested for Normality		W-Test		Normality Result (a = 0.05) Fail	
Critical Value		9.14E-01		Calculated Value for dataset 4.69E-01	
Anderson Darling (AD) A ²		5.47E+00		AD Probability Fail 1.76E-03	
90% UCL of the MVUE		2.18E+00		95% UCL of the MVUE 2.25E+00	
EPA Concentration Term		2.25E+00		Chebychev 95% UCL 2.61E+00	
Jackknife Results					
Jackknifed Mean		2.00E+00		Jackknifed Standard Error 2.25E-01	
90% UCL of the mean		2.29E+00		95% UCL of the mean 2.38E+00	
90% UCL of the MVUE ²		2.22E+00		95% UCL of the MVUE ² 2.30E+00	
Bootstrap Results (Raw Data)					
Standard Bootstrap		Mean	2.01E+00	90% UCL	2.30E+00
		Skewness	5.52E-01	Kurtosis	2.87E+00
Quantile fit is good - Bootstrap Output is Normal or nearly so					
Pivitol (t) Bootstrap		90% UCL	2.93E+00	95% UCL	3.90E+00
		Skewness	-3.16E+01	Kurtosis	9.98E+02
Quantile fit is poor do not use Bootstrap Results					
Hall's t Bootstrap		90% UCL	2.93E+00	95% UCL	3.88E+00
		Skewness	-3.16E+01	Kurtosis	9.98E+02
Quantile fit is poor do not use Bootstrap Results					

RECOMMENDED ENVIRONMENTAL EXPOSURE POINT CONCENTRATIONS (EPCs)

Toxaphene Soil

There is a sufficient number of values for statistical analysis - the data were found to be non-normally distributed with high bias and low skewness - use the Standard Bootstrap mean and "t" Bootstrap UCLs as the EPCs

(Nondetect data presented as 1/2 the DL)

Units = PPB

Sample#	Value	Qualifier
1	120	
2	28.5	
3	100	
4	115	
5	145	
	130	
7	180	
8	140	
9	95	
10	23.5	
11	34.5	
12	30.5	
13	22.5	
14	210	
15	110	
16	22.5	
17	22.5	
18	37	
19	25.5	
20	23.5	
21	32	
22	115	
23	39	

Low-End EPC	Bootstrap Mean			78.71395652	
High-End EPC	Pivotal Bootstrap UCL			102.2404742	
Raw Data Results					
Number of Samples	23				
Percent Detection	100%	23 of 23	Percent Detects J-coded	0%	
Maximum Detection	2.10E+02		Minimum Detection	2.25E+01	
Maximum Non-detection ¹	All Detects		Minimum Non-detection ¹	All Detects	
Normal (Non-transformed) Results					
Normal Mean	7.83E+01		Mean Standard Error	1.22E+01	
Standard Deviation	5.84E+01		Coefficient of Variance (%)	75%	
Dataset Skewness	Pass	5.84E-01	Dataset Kurtosis	Pass	2.01E+00
Tested for Normality	W-Test		NormalityResult (a = 0.05)	Fail	
Critical Value	9.14E-01		Calculated Value for dataset	8.45E-01	
90% UCL using t-statistic	9.44E+01		95% UCL using -t-statistic	9.92E+01	
Natural Log-Transformed Results					
MVUE of the log-mean	7.93E+01		Standard error of the log-mean	1.47E+01	
Standard Deviation	8.12E-01		Coefficient of Variance (%)	20%	
Dataset Skewness	Pass	1.13E-01	Dataset Kurtosis	Fail	1.20E+00
Tested for Normality	W-Test		Normality Result (a = 0.05)	Fail	
Critical Value	9.14E-01		Calculated Value for dataset	8.47E-01	
Anderson Darling (AD) A ²	1.48E+00		AD Probability	Fail	1.81E-01
90% UCL of the MVUE	1.08E+02		95% UCL of the MVUE	1.20E+02	
EPA Concentration Term	1.20E+02		Chebychev 95% UCL	1.45E+02	
Jackknife Results					
Jackknifed Mean	7.83E+01		Jackknifed Standard Error	1.22E+01	
90% UCL of the mean	9.44E+01		95% UCL of the mean	9.92E+01	
90% UCL of the MVUE ²	9.82E+01		95% UCL of the MVUE ⁴	1.04E+02	
Bootstrap Results (Raw Data)					
Standard Bootstrap	Mean	7.87E+01	90% UCL	9.41E+01	95% UCL 9.84E+01
Skewness	4.88E-02		Kurtosis	3.03E+00	
Quantile fit is good - Bootstrap Output is Normal or nearly so					
Pivitol (t) Bootstrap	90% UCL	9.55E+01		95% UCL	1.02E+02
Skewness	-4.48E-01		Kurtosis	3.75E+00	
Quantile fit is good - Bootstrap Output is Normal or nearly so					
Hall's t Bootstrap	90% UCL	9.61E+01		95% UCL	1.03E+02
Skewness	-1.00E+00		Kurtosis	5.72E+00	
Quantile fit is good - Bootstrap Output is Normal or nearly so					

RECOMMENDED ENVIRONMENTAL EXPOSURE POINT CONCENTRATIONS (EPCs)

TOC Soil

There is a sufficient number of values for statistical analysis - the data were found to be non-normally distributed with high bias and low skewness - use the Standard Bootstrap mean and "t" Bootstrap UCLs as the EPCs

(Nondetect data presented as 1/2 the DL)

Units = PPM

Sample# Value Qualifier

SB-1 95000
SB-2 120000
SB-3 120000
SB-4 120000
SB-5 100000
SB-6 100000
SB-7 110000
SB-8 50000
SB-9 81000
SB-10 130000
SB-11 110000
SB-12 140000
SB-14 46000
SB-15 100000
SB-16 120000
SB-17 36000
SB-18 37000
SB-19 140000
SB-20 66000
SB-21 16000
SB-22 110000
SB-23 99000
SB-24 120000

Low-End EPC	Bootstrap Mean		94194.78261	
High-End EPC	Pivotal Bootstrap UCL		106518.5978	
Raw Data Results				
Number of Samples	23			
Percent Detection	100%	23 of 23	Percent Detects J-coded	0%
Maximum Detection	1.40E+05		Minimum Detection	1.60E+04
Maximum Non-detection ¹	All Detects		Minimum Non-detection ¹	All Detects
Normal (Non-transformed) Results				
Normal Mean	9.42E+04		Mean Standard Error	7.40E+03
Standard Deviation	3.55E+04		Coefficient of Variance (%)	38%
Dataset Skewness	Pass	-7.27E-01	Dataset Kurtosis	Pass 2.26E+00
Tested for Normality	W-Test		NormalityResult (a = 0.05)	Fail
Critical Value	9.14E-01		Calculated Value for dataset	8.95E-01
90% UCL using t-statistic	1.04E+05		95% UCL using -t-statistic	1.07E+05
Natural Log-Transformed Results				
MVUE of the log-mean	9.73E+04		Standard error of the log-mean	1.16E+04
Standard Deviation	5.45E-01		Coefficient of Variance (%)	5%
Dataset Skewness	Fail	-1.49E+00	Dataset Kurtosis	Pass 4.51E+00
Tested for Normality	W-Test		Normality Result (a = 0.05)	Fail
Critical Value	9.14E-01		Calculated Value for dataset	7.86E-01
Anderson Darling (AD) A ²	1.91E+00		AD Probability	Fail 1.04E-01
90% UCL of the MVUE	1.17E+05		95% UCL of the MVUE	1.24E+05
EPA Concentration Term	1.24E+05		Chebychev 95% UCL	1.49E+05
Jackknife Results				
Jackknifed Mean	9.42E+04		Jackknifed Standard Error	7.40E+03
90% UCL of the mean	1.04E+05		95% UCL of the mean	1.07E+05
90% UCL of the MVUE ²	1.07E+05		95% UCL of the MVUE ²	1.10E+05
Bootstrap Results (Raw Data)				
Standard Bootstrap	Mean	9.42E+04	90% UCL	1.04E+05
	Skewness	-3.62E-01	Kurtosis	3.50E+00
Quantile fit is good - Bootstrap Output is Normal or nearly so				
Pivitol (t) Bootstrap	90% UCL	1.04E+05	95% UCL	1.07E+05
	Skewness	7.38E-01	Kurtosis	8.44E+00
Quantile fit is good - Bootstrap Output is Normal or nearly so				
Hall's t Bootstrap	90% UCL	1.04E+05	95% UCL	1.07E+05
	Skewness	8.51E-01	Kurtosis	5.91E+00
Quantile fit is good - Bootstrap Output is Normal or nearly so				

Concentrations mg/kg dw	
Chlordane (SGGE)	
sediment (d.w.)	0.024
pore water	0.000001
surface water	8.72E-08
algae	0.000
zooplankton	0.000
benthos	0.002
forage fish	0.002
T3 fish	0.004
T4 fish	0.005
TOC (sedw)	9.4

Hazard Quotients				
Chlordane (SGGE)	white pelican	wood stork	great blue heron	bald eagle
Dose (mg/kg/day)	0.000	0.000	0.001	0.000
HQ LD50m	0.000	0.000	0.000	0.000
HQ LD50med	0.000	0.000	0.000	0.000
HQ rep0NOAEL	0.002	0.001	0.003	0.001
HQ rep0LOAEL	0.000	0.000	0.001	0.000

Chlordane (SGGE)	benthos	forage fish	T3 fish	T4 fish
HQ CBRlow	0.002	0.004	0.007	0.008
HQ CBRhigh	0.001	0.001	0.001	0.002

Chlordane (SGGE)	white pelican	wood stork	great blue heron	bald eagle
HQ LD50m				
HQ LD50med				
HQ rep0NOAEL				
HQ rep0LOAEL				

Chlordane (SGGE)	benthos	forage fish	T3 fish	T4 fish
HQ CBRlow				
HQ CBRhigh				

**Concentrations
in the environment**

Toxaphene	
sediment (dwt)	0.102
lake water	0.000002
surface water	1.79E-07
algae	0.001
zooplankton	0.006
benthos	0.020
forage fish	0.028
T3 fish	0.051
T4 fish	0.063
TOC (%:wt)	9.4

Estimated Doses

Toxaphene	white pelican	wood stork	great blue heron	bald eagle
Dose (mg/kg/day)	0.006	0.005	0.010	0.005
HQ (LD50/mg)	0.000	0.000	0.001	0.000
HQ (LD50/mg)	0.000	0.000	0.000	0.000
HQ (reprod/AEL)	0.011	0.009	0.019	0.009
HQ (reprod/AEL)	0.007	0.006	0.013	0.006

Toxaphene	benthos	forage fish	T3 fish	T4 fish
HQ (CBR)w	0.055	0.036	0.064	0.079
HQ (CBR)h	0.007	0.016	0.028	0.035

Toxaphene	white pelican	wood stork	great blue heron	bald eagle
HQ (LD50/mg)				
HQ (LD50/mg)				
HQ (reprod/AEL)				
HQ (reprod/AEL)				

Toxaphene	benthos	forage fish	T3 fish	T4 fish
HQ (CBR)w				
HQ (CBR)h				